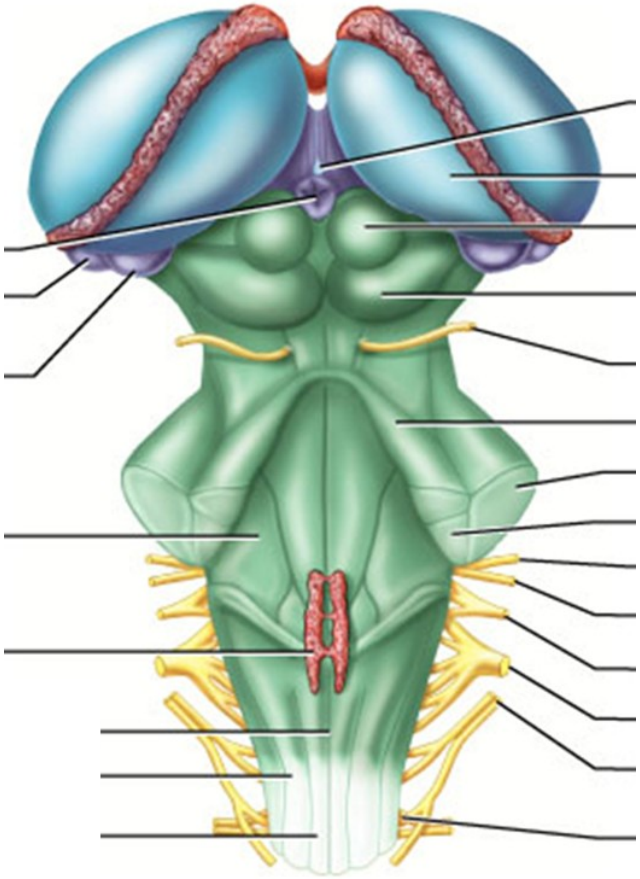
The Brain Stem

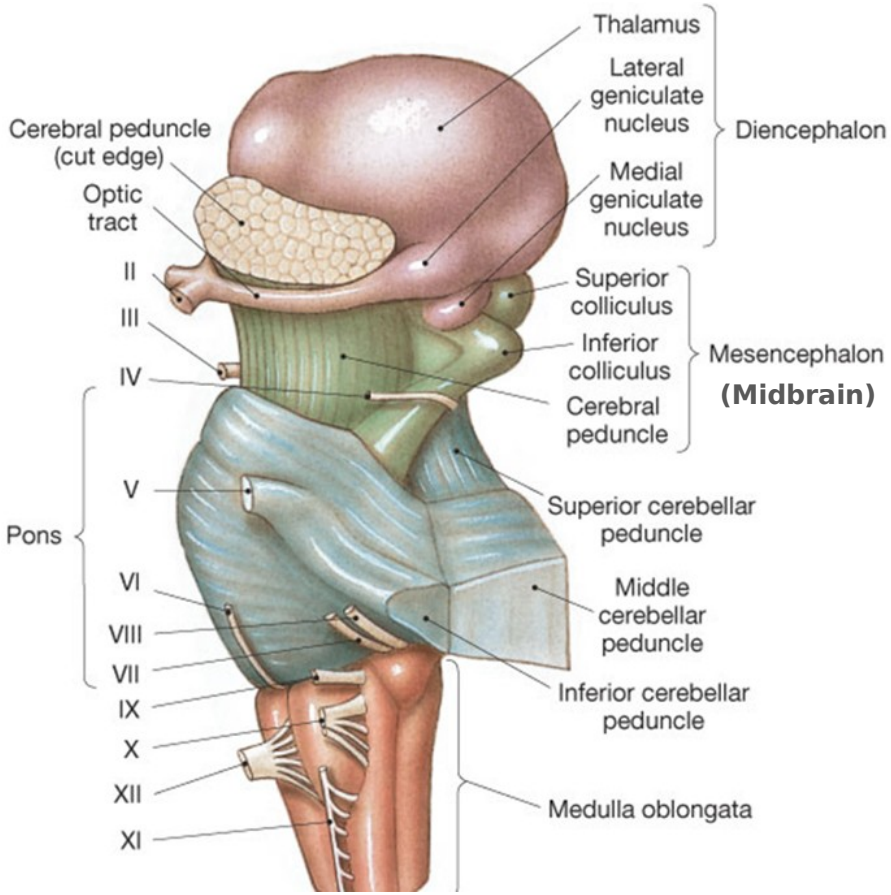


Midbrain

Pons

Medulla

Posterior View



Lateral View

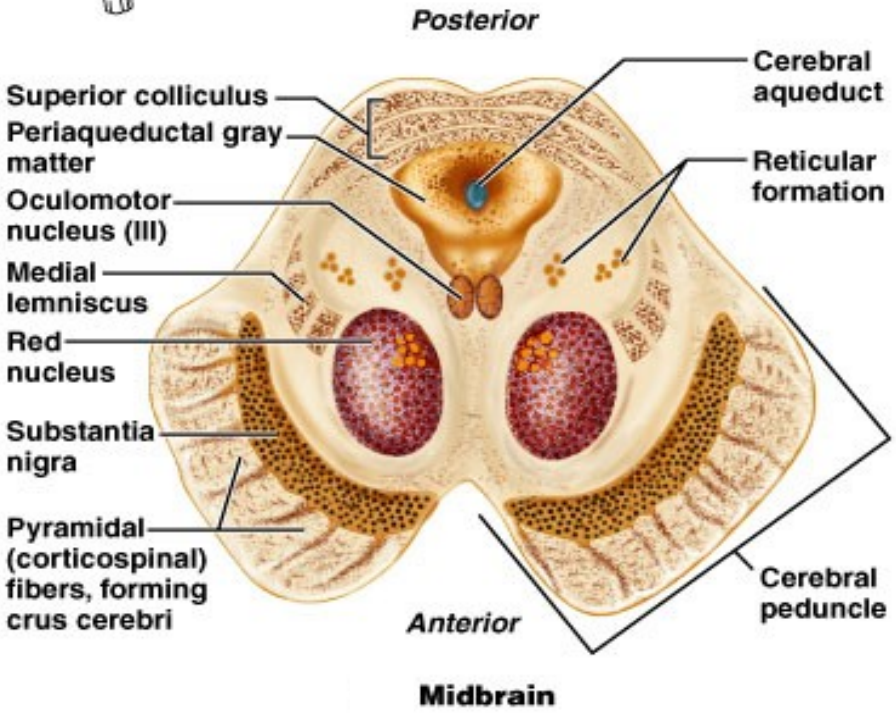
Midbrain

Substantia nigra

= black substance

Corpora quadrigemina

= ‘four bodies’ (2 pairs)

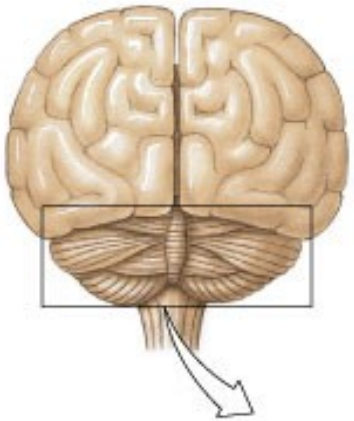


Superior colliculi

=> nuclei that act in visual reflexes (vision).

Inferior colliculi

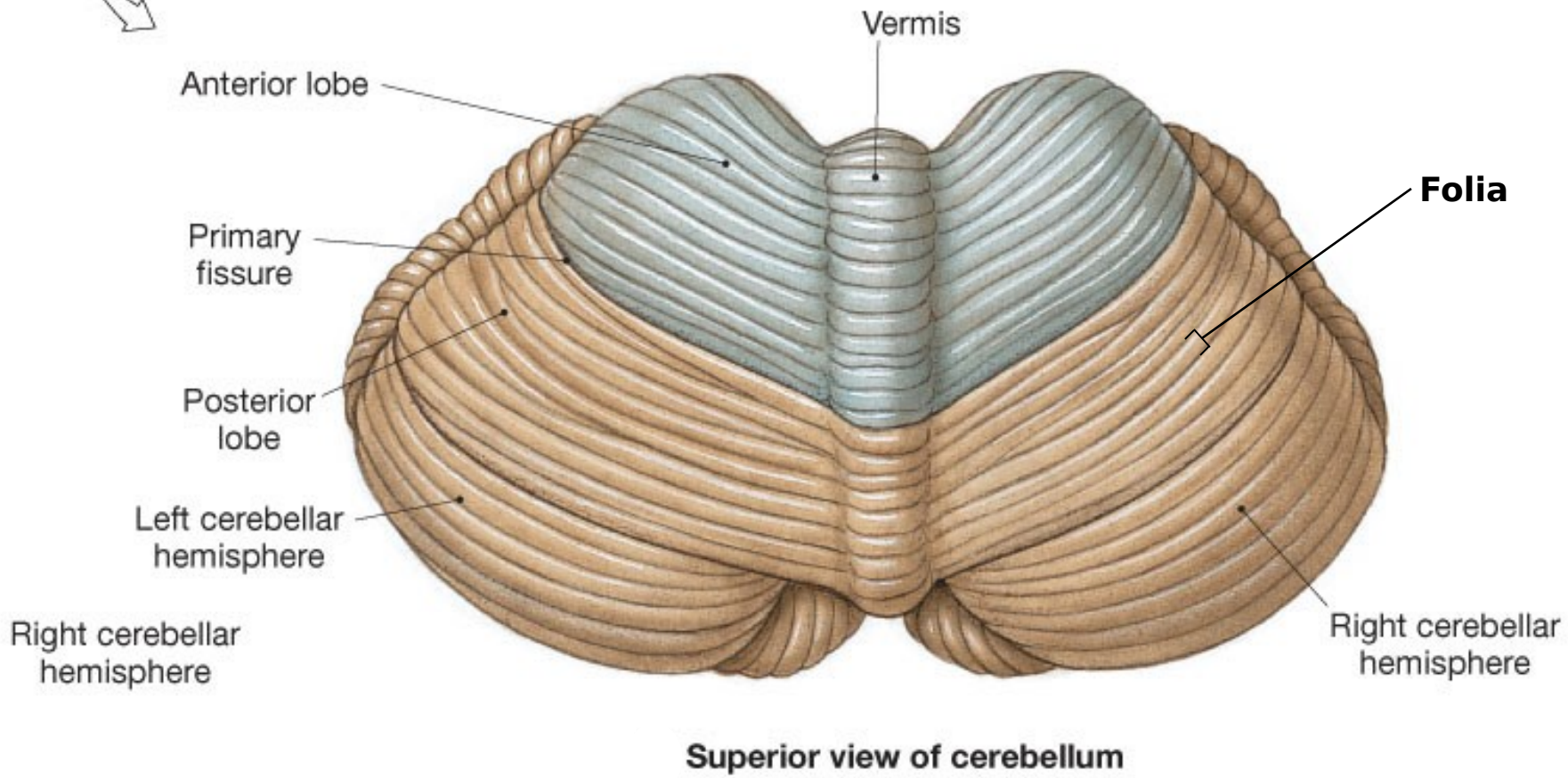
=> nuclei that act in auditory reflexes (sound).



The Cerebellum – superior view

Located dorsal to the pons and medulla

Consists of two cerebellar hemispheres



Superior view of cerebellum

Functions of Cerebellum

Located dorsal to the pons and medulla

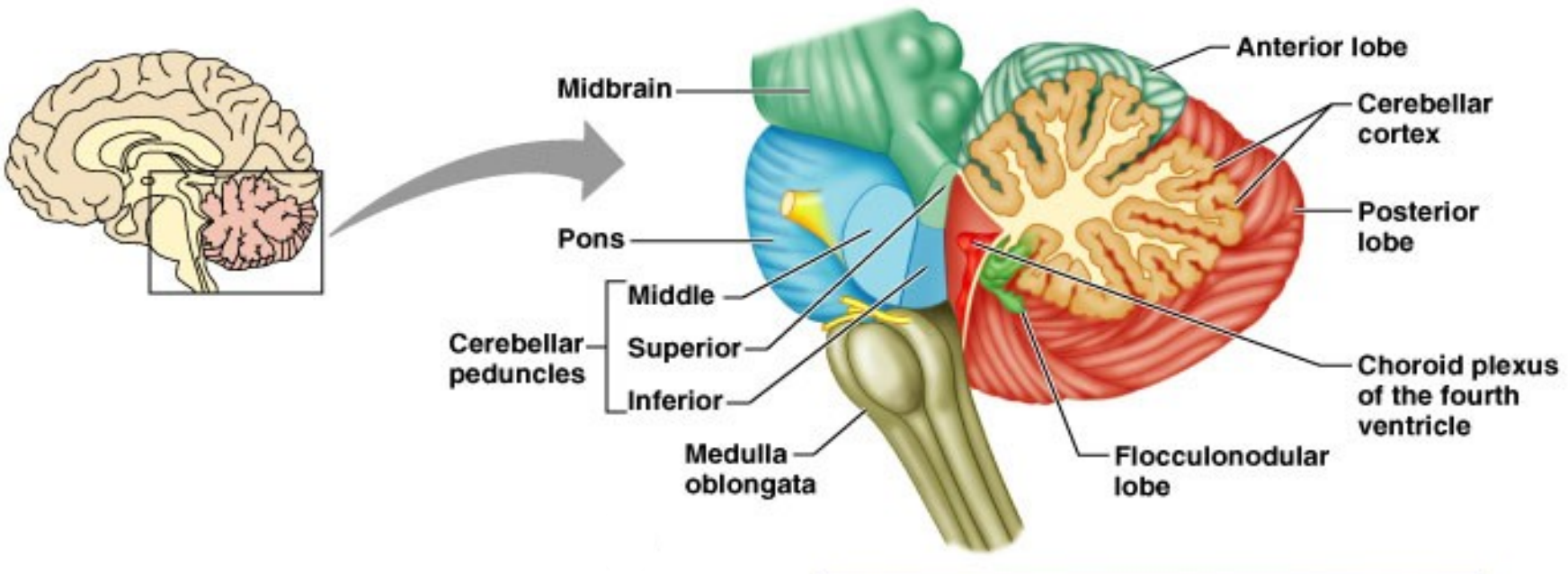
1) Controls postural reflexes:

- coordinates rapid, automatic adjustments of muscles in body to maintain equilibrium.

2) Produces skilled movements:-

- implements routines for fine tuned movements.

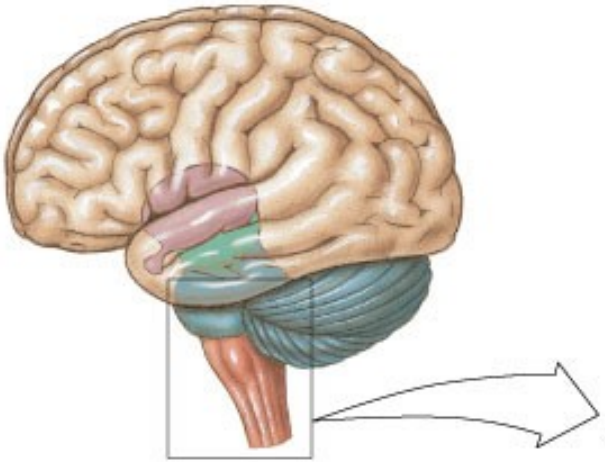
Refines learned routines until the action

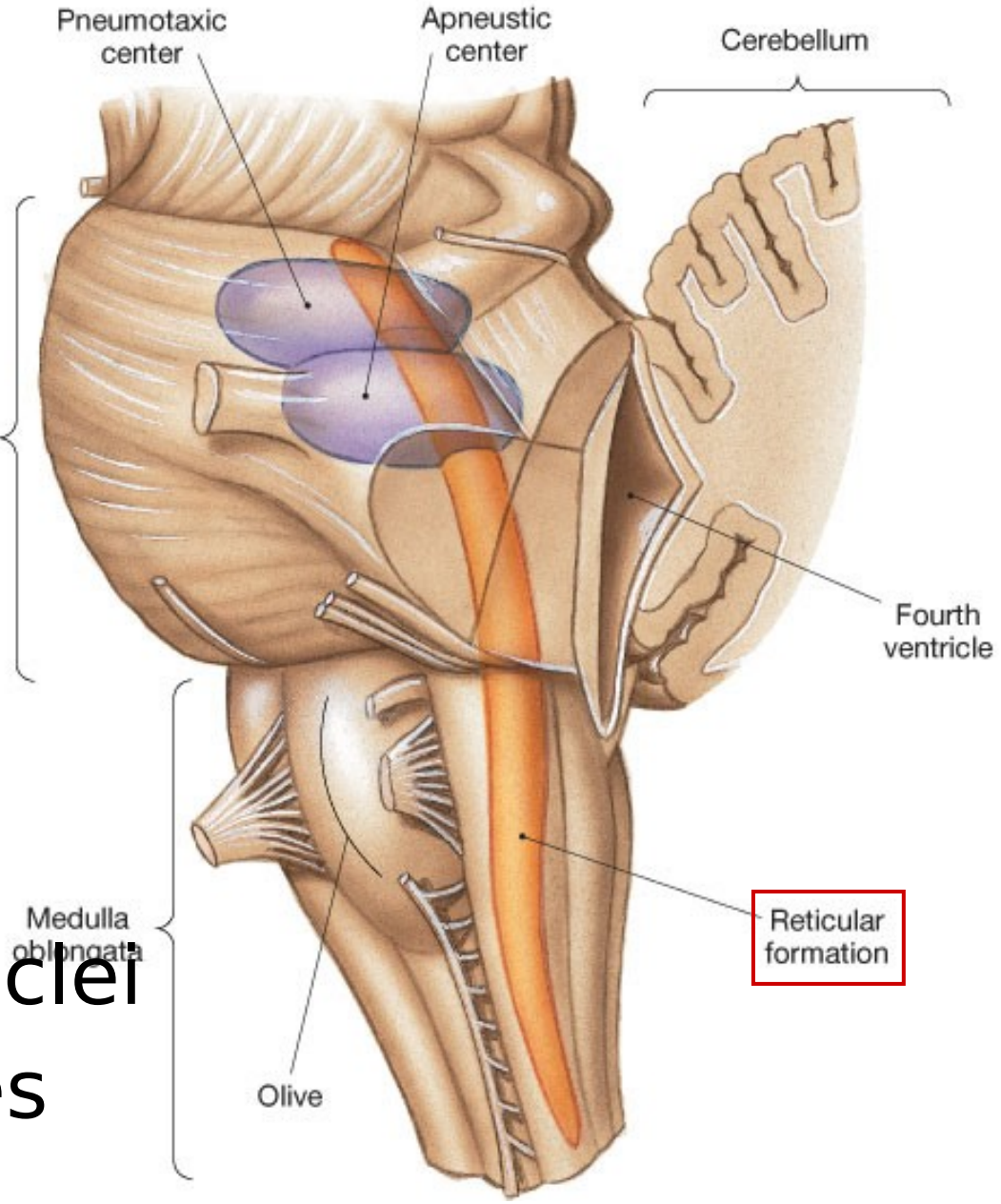


Thick tracts connecting the cerebellum to the brain s

uperior, Middle and Inferior **Cerebellar Peduncles**

ibers to and from the cerebellum are **ipsilateral -**
un to and from the *same* side of the body

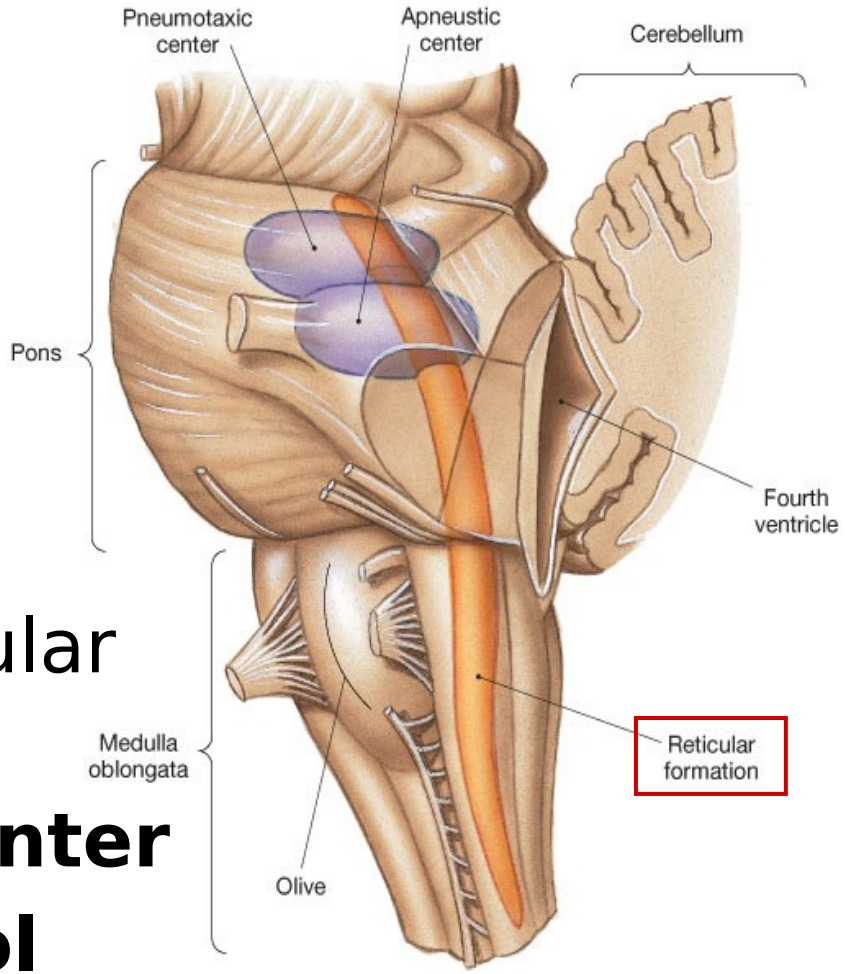




- **Pons**

* Contains the pontine respiratory centers.
* Contains the nuclei of cranial nerves V, VI, and VII

- The Medulla contains:
  - Much of the reticular formation
  - Nuclei influence autonomic functions



Vital centers of the reticular formation:

1) **Cardiac Control Center**
2) **Respiratory Control Center**
3) **Vasomotor Control Center**

- Also contains centers for hiccupping, sneezing,

swallowing, vomiting and coughing.

Protection of the Brain

The Skull

Cranial

Meninges

Cerebrospinal Fluid

Blood-Brain Barrier

anial Meninges - 3-layer protective membra

1. Dura Mater - Composed of two layers:

a) Periosteal (Endosteal) – outer layer attaches to bone.

b) Meningeal – inner layer, closer to brain.

(These two layers fused, except to enclose the dural sinuses)

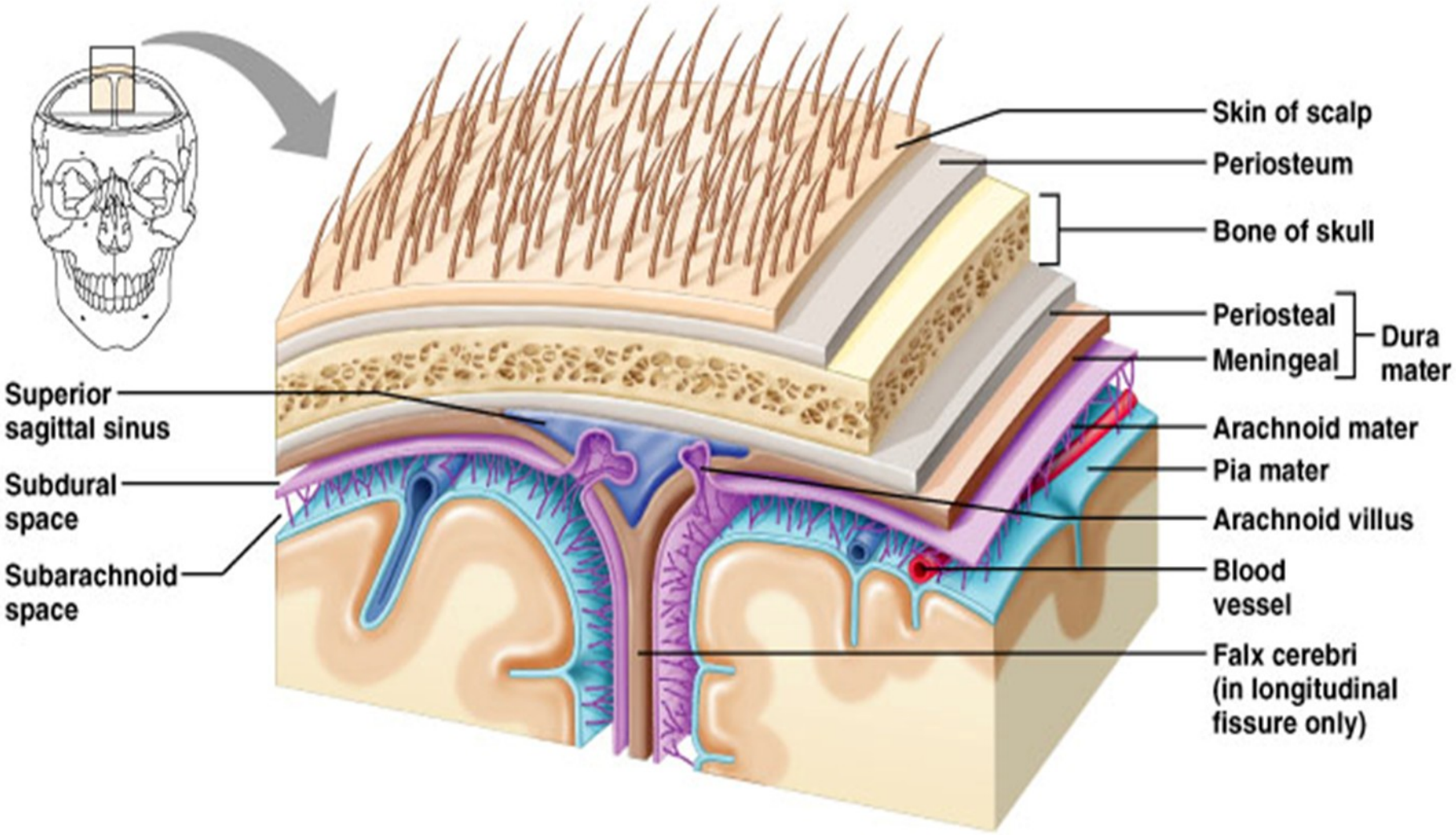
omposed of dense irregular connective tissue.

Arachnoid Layer - 'spider' web-like layer.

omposed of loose/fibrous connective tissue.

3. Pia Mater - delicate, follows convolutions.

sed of an outer collagen layer, & inner epithelial elastic and reticular fi


Skin of scalp
Periosteum
Bone of skull
Periosteal
Meningeal
Dura mater
Superior sagittal sinus
Arachnoid mater
Pia mater
Subdural space
Arachnoid villus
Subarachnoid space
Blood vessel
Falx cerebri (in longitudinal fissure only)

Cranial Meningeal Spaces

Epidural space

Potential space superior to dura.

Subdural space

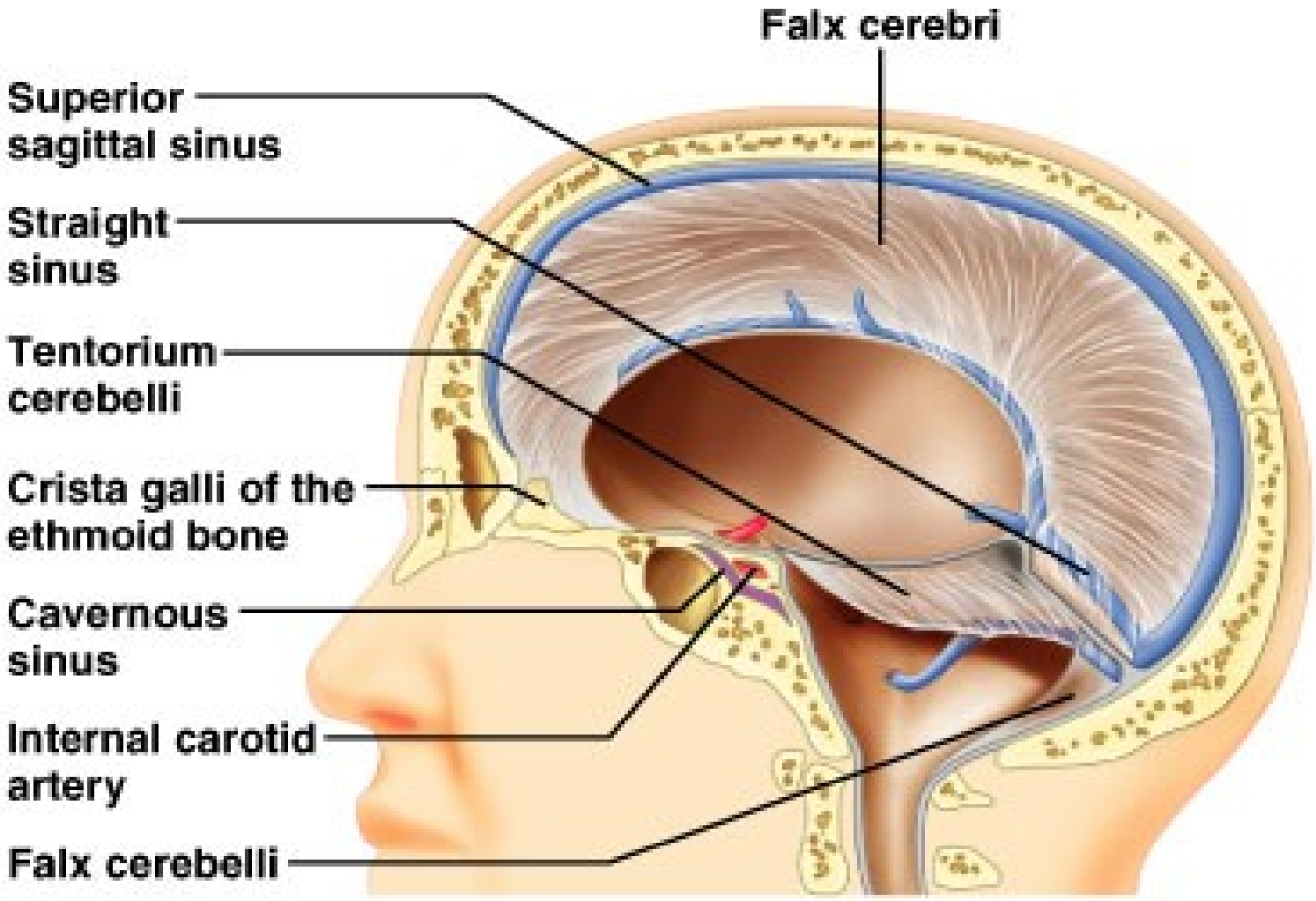
Potential space between dura and arachnoid mater.

Subarachnoid space

Filled with CSF

Contains the blood vessels supplying brain.

nuses = Large Veins (in cardiovascular s



Cerebrospinal Fluid (CSF)

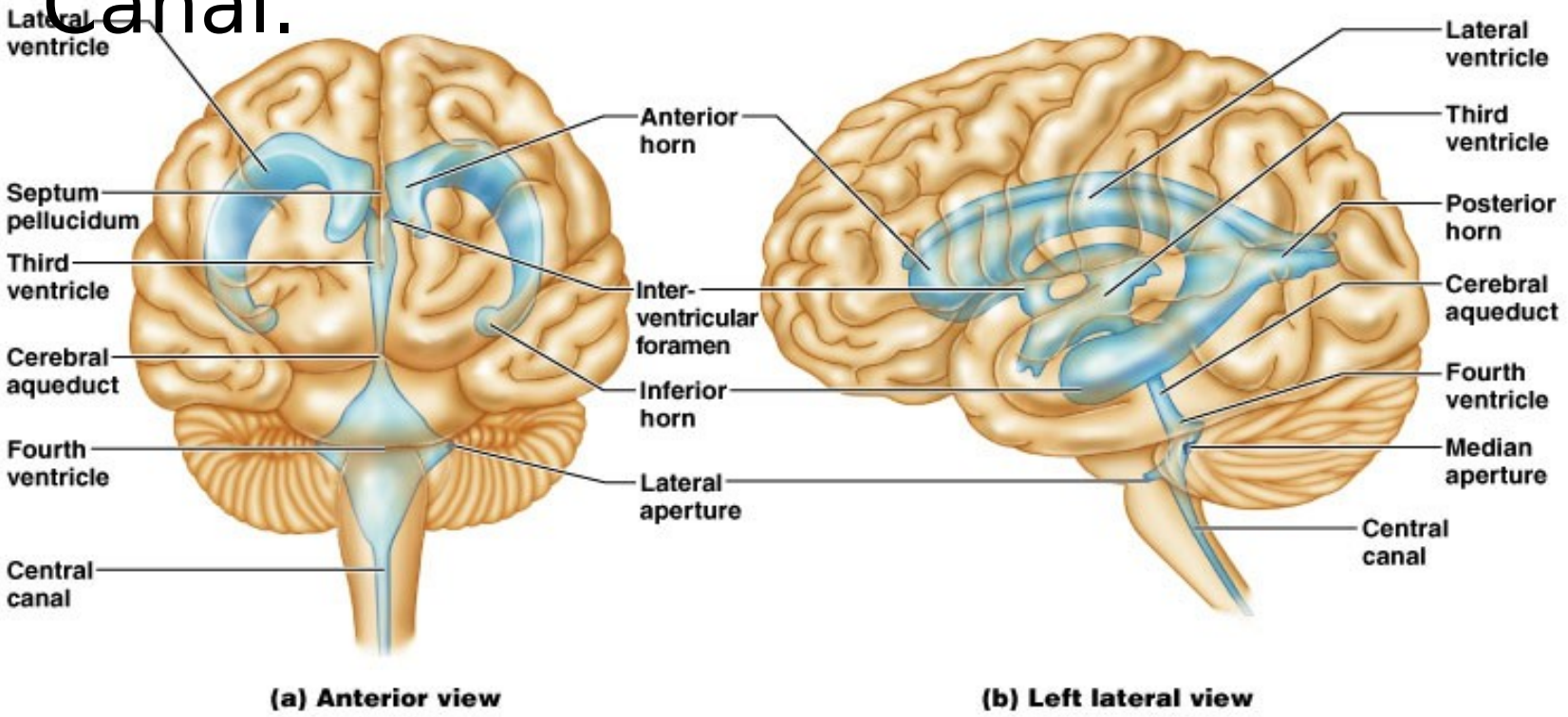
Roles of CSF:

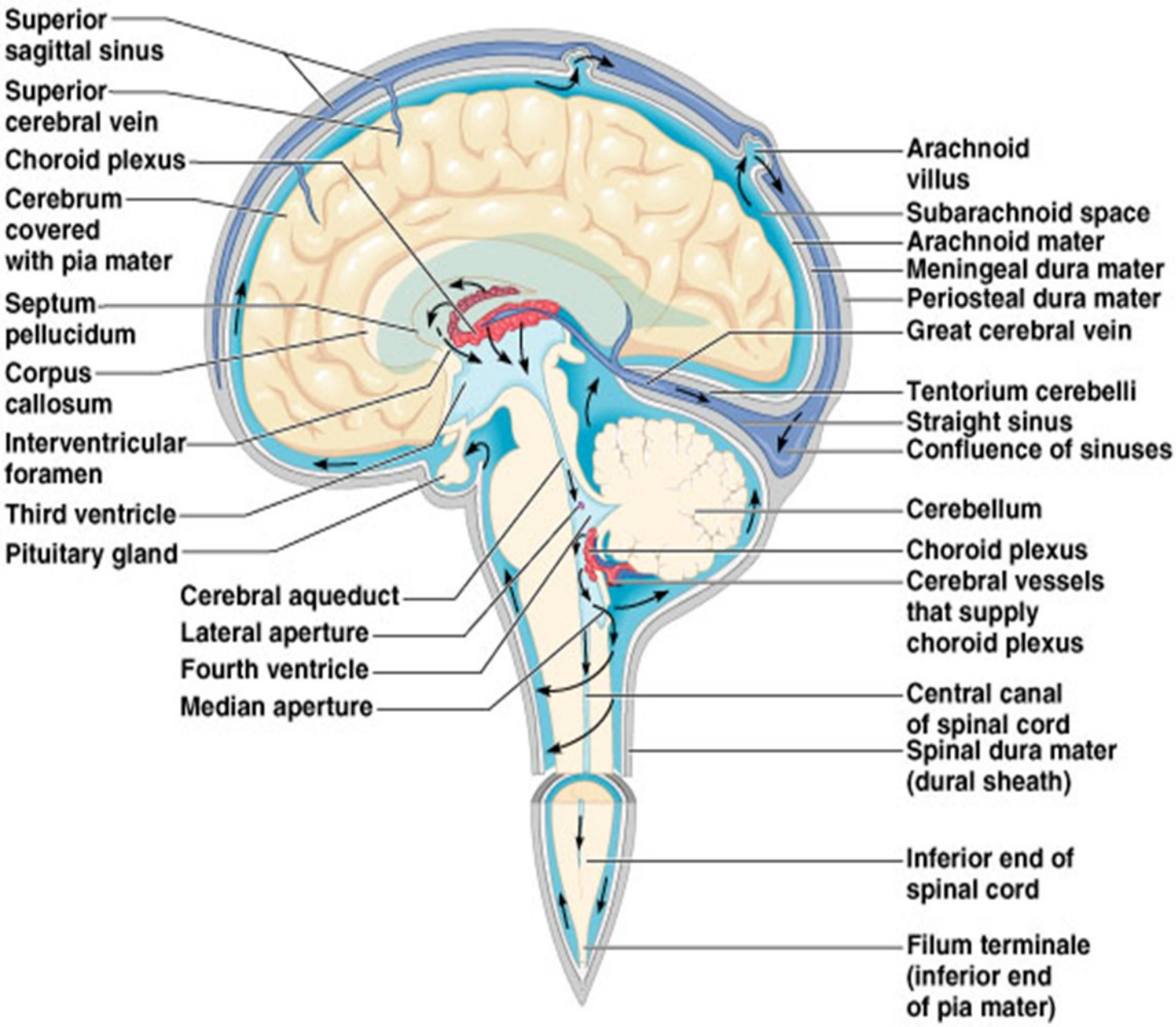
1. Cushions and insulates delicate nervous tissue.
2. Gives Buoyancy to the brain ("floats" in CSF).
3. Exchange of gases (O_2 and CO_2), nutrients and wastes.

SF formed in the **choroid plexuses** in ventricles of

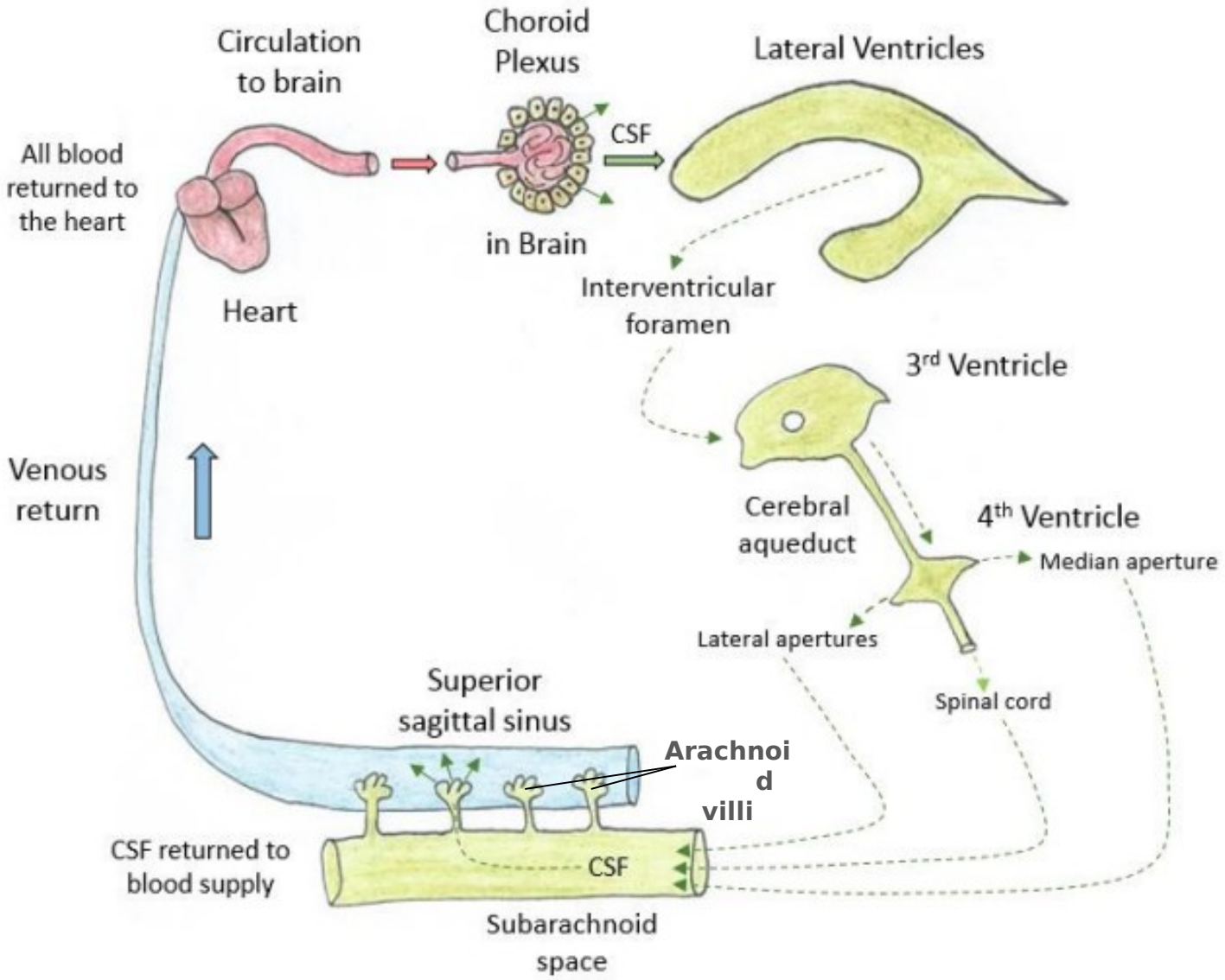
CSF Circulates in:

Chambers, Spaces, and the Central Canal.



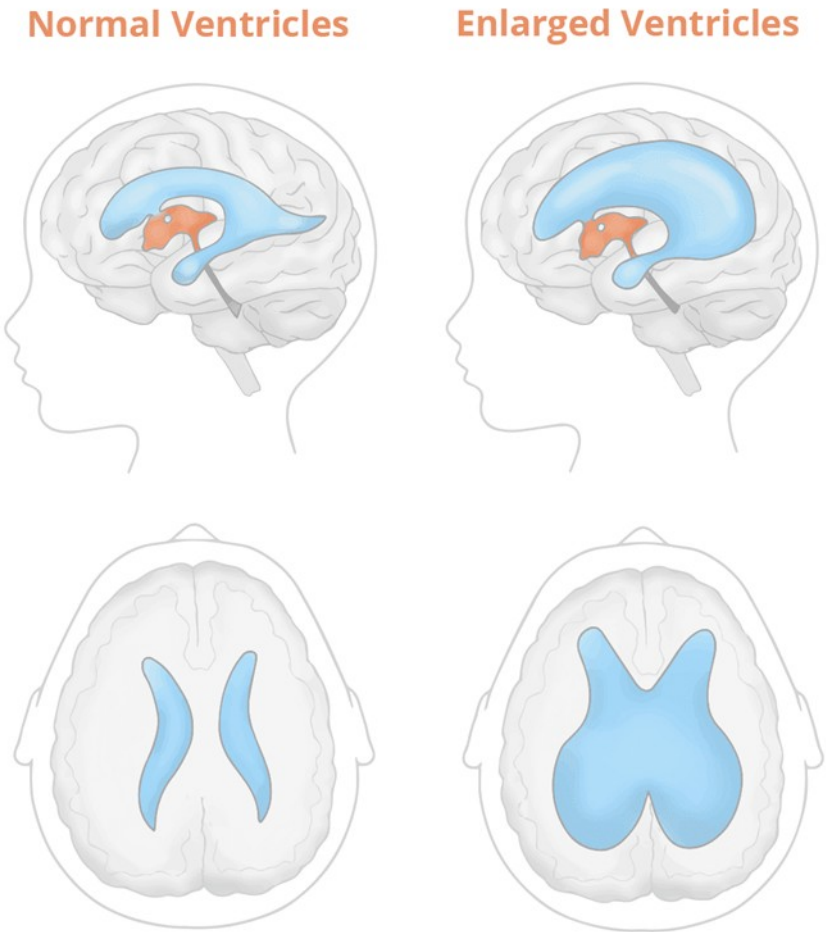

Superior sagittal sinus
Superior cerebral vein
Choroid plexus
Cerebrum covered with pia mater
Septum pellucidum
Corpus callosum
Interventricular foramen
Third ventricle
Pituitary gland
Cerebral aqueduct
Lateral aperture
Fourth ventricle
Median aperture
Arachnoid villus
Subarachnoid space
Arachnoid mater
Meningeal dura mater
Periosteal dura mater
Great cerebral vein
Tentorium cerebelli
Straight sinus
Confluence of sinuses
Cerebellum
Choroid plexus
Cerebral vessels that supply choroid plexus
Central canal of spinal cord
Spinal dura mater (dural sheath)
Inferior end of spinal cord
Filum terminale (inferior end of pia mater)

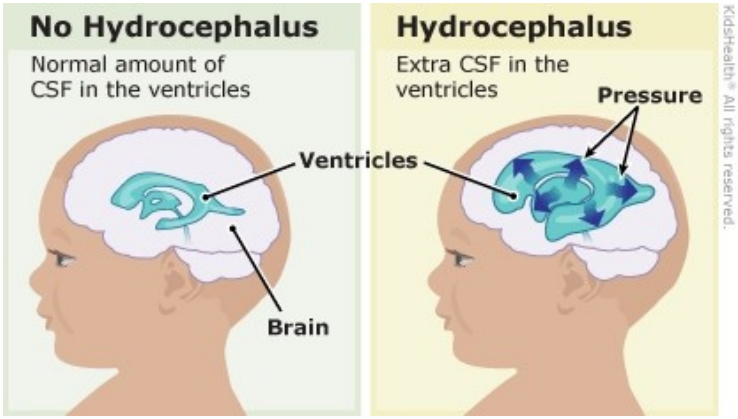
Cerebrospinal Fluid Circulation



CSF Circulation

Hydrocephalus





Blood Brain Barrier (BBB)

A restrictive barrier around blood vessels in the brain (created by astrocytes).

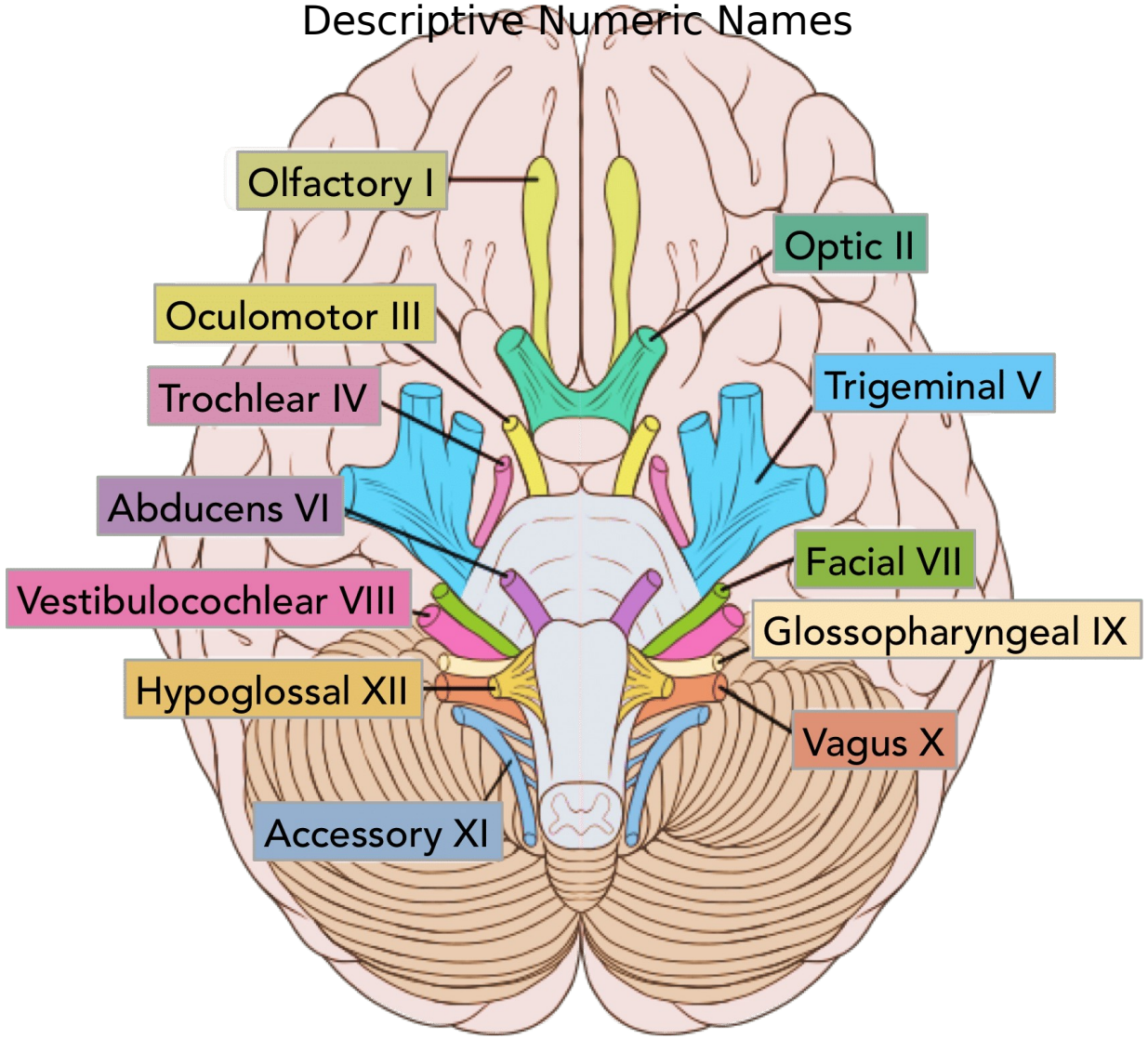
Prevents most blood-borne toxins from entering the brain but not an *absolute* barrier.

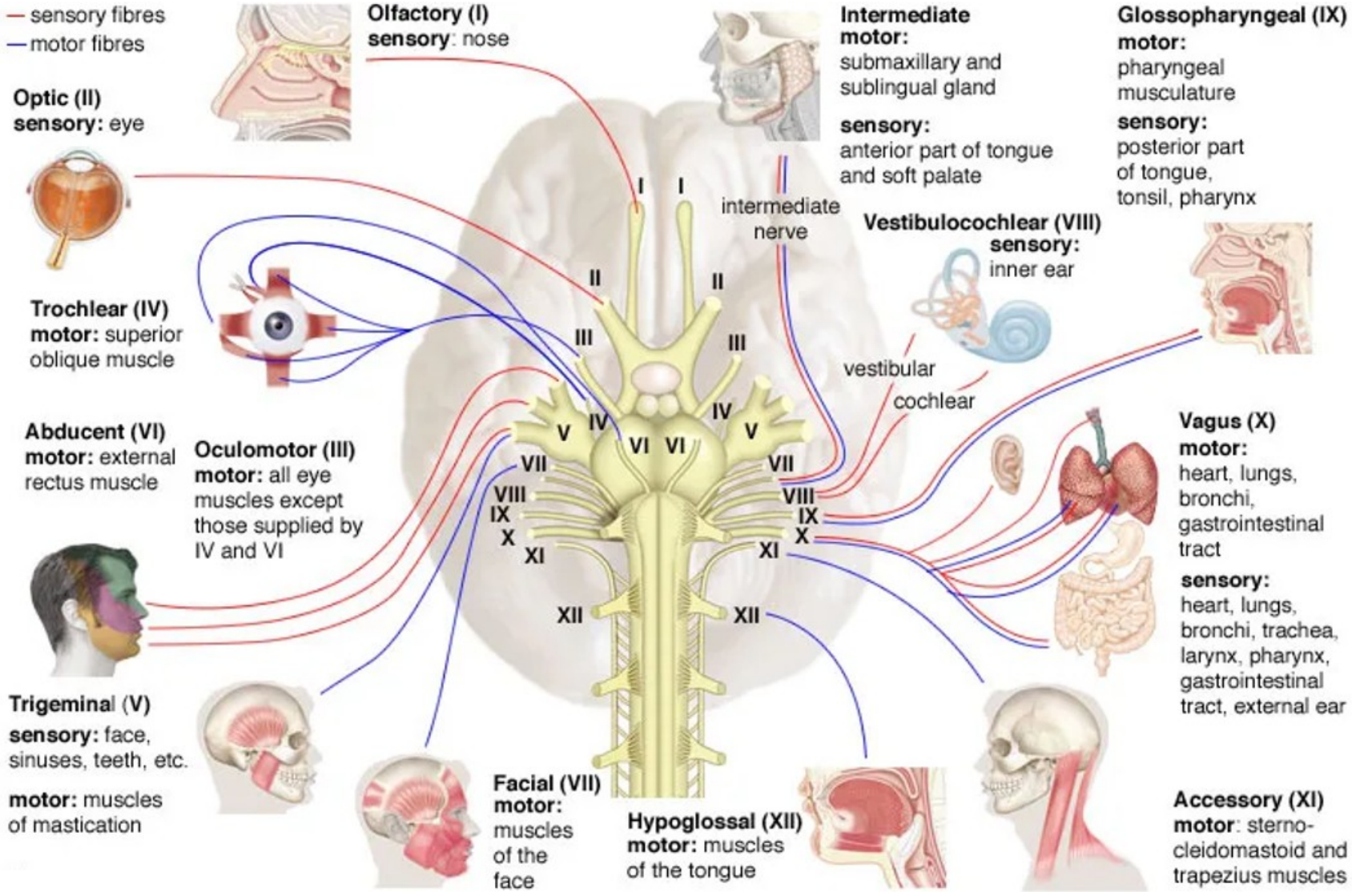
Nutrients such as O_2, and glucose can pass. Plus CO_2, alcohol, nicotine, and anesthetics.

Dopamine? L-Dopa?

The 12 Pairs of Cranial Nerves

Descriptive Numeric Names




sensory fibres
motor fibres
Olfactory (I)
sensory: nose
Optic (II)
sensory: eye
Trochlear (IV)
motor: superior oblique muscle
Abducent (VI)
motor: external rectus muscle
Oculomotor (III)
motor: all eye muscles except those supplied by IV and VI
Trigeminal (V)
sensory: face, sinuses, teeth, etc.
motor: muscles of mastication
Facial (VII)
motor: muscles of the face
Hypoglossal (XII)
motor: muscles of the tongue
Intermediate
motor: submaxillary and sublingual gland
sensory: anterior part of tongue and soft palate
intermediate nerve
Vestibulocochlear (VIII)
sensory: inner ear
vestibular
cochlear
Glossopharyngeal (IX)
motor: pharyngeal musculature
sensory: posterior part of tongue, tonsil, pharynx
Vagus (X)
motor: heart, lungs, bronchi, gastrointestinal tract
sensory: heart, lungs, bronchi, trachea, larynx, pharynx, gastrointestinal tract, external ear
Accessory (XI)
motor: sterno-cleidomastoid and trapezius muscles
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII

Cranial Nerves	Origins	Innervation	General Functions
Olfactory N. I (s)	Cerebrum, olfactory tract and bulb.	The nasal mucosa.	Detects and conveys sense of smell from the nose to the temporal lobe for perception of smells.
Optic N. I II (s)	Optic disc (posterior retina). Ganglion cells of retina, enters the skull via optic canal on way to optic chiasm.	Photoreceptors (Rods and Cones) of the Retina (neural tunic).	Transmits visual information from the eyes to the brain for perception.
Oculomotor N. III (m)	From midbrain of brainstem, exits skull and enters orbit via the superior orbital fissure.	4 extrinsic ocular muscles; ciliary muscle, sphincter pupillae muscle.	For control of the movement of the eyeball. Also, for constriction of pupil (miosis), controls levator palpebrae superioris, and lens accommodation.
Trochlear N. IV (m)	From midbrain of brainstem, exits skull and enters the orbit via the superior orbital fissure.	The extrinsic superior oblique muscle of eye.	Controls 1 extrinsic eye muscle (the superior oblique), for an inferolateral rotation (down and out).
Trigeminal N. V (b)	Pons of brainstem. Ophthalmic N. via superior orbital fissure, Maxillary N. via foramen rotundum, and Mandibular N. via foramen ovale.	Muscels and tissues of the head, and face, sinuses, and teeth.	Sensations of forehead, orbits and nose; cheek, upper lip; lower lip, buccal and mandible. Muscles of mastication (chewing).
Abducens N. VI (m)	Pons of brainstem. Exits skull via the superior orbital fissure.	Lateral rectus extrinsic muscle of the eye.	Abducts the eyeball (looking laterally).

Cranial Nerves	Origins	Innervation	General Functions
Facial N. VII (b)	Pons of brainstem. Leaves brain via stylomastoid foramen. Part of the Parasympathetic division.	Facial muscles. Tastebuds, lacrimal and sublingual, submandibular salivary glands.	Muscles of facial expression. Taste for anterior two-thirds of tongue. Generates tears and saliva.
Vestibulocochlear N. VIII (s)	Pons and medulla oblongata of brainstem.	The inner ear, both the vestibular complex (including the utricle and saccule); and the cochlear for hearing.	Vestibular branch: Conveys signals to the vestibular complex which integrates the relative position of the head with other body parts to maintain balance (equilibrium). Cochlear branch: Sends sound info from the inner ear (cochlea) to the brain (auditory cortex temporal lobe).
Glossopharyngeal N. IX (b)	Leaves brain from medulla oblongata of brainstem via jugular foramen. Part of the Parasympathetic division.	Laryngeal and pharyngeal muscles for swallowing; parotid gland. Posterior one-third of tongue. Carotid bodies within the carotid sinus.	Acts to elevate larynx and pharynx when swallowing and dilates pharynx during swallowing and speech. Responsible for the 'gag reflex'. Taste sensation posterior one-third of tongue. Detects dissolved gas levels in carotid bodies of carotid sinus.
Vagus N. X (b)	Leave brain from medulla oblongata of Brainstem, exits the skull via jugular foramen. Significant (75%) part of the Parasympathetic division.	Acts on the tongue, pharynx, laryngeal muscles that control the voice, the heart, and the gastrointestinal system.	Controls thoracic abdominal viscera laryngeal and pharyngeal muscles Sensation of epiglottis; thoracic and abdominal viscera, carotid body external acoustic meatus. Also has gag reflex.
Accessory N. XI (m)	From medulla oblongata of brainstem and from the	Laryngeal muscles, sternocleidomastoid,	For head movements, such as rotation, flexion, lateral flexion,

Testing the 12 Cranial Nerves